11-bit spread code is used and the combination of multiplexing location has 4 variations. However, such combination can be allowed to have maximum of 55 variations. For example, data transmission at 9 Mbps can be realized by transmitting 32 variations of those combinations as the location information. Additionally the 13-bit Barker code further allows for the transmission at maximum of 10 Mbps in spite of 2 multiplexings.

The above-constructed present invention, thus, presents the following advantageous effects:

(1) A code generator is provided to produce a plurality of codes, each at a differently shifted timing from a spread code. Those codes are used for the code division multiplexing, by which the communication with larger capacity is realized.

(2) Using the Barker code with excellent autocorrelation characteristics allows for code division multiplexing exhibiting high transmission characteristics.

(3) The information on the relative timing location of signals is considered for multiplexing, thus further expanding the transmission capacity.

(4) The equalizer for removing the delay distortion of the signal generated on the transmission path of the receiver is provided. The influence of the delay distortion generated on the transmission path on the communication operation can be removed by using a plurality of codes, each at a differently shifted timing from a spread code.

The above advantageous points (1) to (4) allow for spectrum spread communication at an increased transmission rate twice or further higher than the conventional rate yet at the same spectrum spread ratio and in the same frequency band width.

The present invention has been described in relation to particular embodiments thereof. Many other variations, modifications, and other uses will become apparent to those skilled in the art. Accordingly, the invention is to be limited not by the disclosure herein, but only by the appended claims.

What is claimed is:

1. A code division multiplexing communication system having a transmitter and a receiver using spectrum spread for transmitting a digital signal between said transmitter and said receiver wherein

said transmitter comprises:

signal distribution means for dividing (k+n×m)-bit serial input signal per symbol timing to n pieces of m bit parallel signals, wherein each k,m is at least 1, and n is a least 2, and outputting j variations of m bit data signals each at a differently-shifted timing from said parallel signals and j selection signals for selecting said m bit data signals, wherein;

code generation means for generating j spread codes each at a differently shifted timing;

j units of spread means for spectrum spreading said m bit data signals based on said spread codes;

selection means for selecting and synthesizing n signals among output signals of said spread means based on said selection signals;

modulation means for modulating an output signal of said selection means; and

analog operation means for converting a frequency of an output signal of said modulation means into a radio frequency and transmitting a signal at a changed frequency to said receiver; and

said receiver comprises:

analog operation means for converting a signal transmitted from said transmitter into a base band signal;

correlation means for taking a correlation between an output signal of said analog operation means and a spread code and outputting a correlation result signal;

equalizing means for removing a delay distortion generated on a transmission path from said correlation result signal;

signal location detection means for detecting timing locations of n signals at the highest level with 1 symbol block and extracting k-bit information from said timing location;

n units of demodulation means for demodulating (n×m)-bit signal based on an output signal of said equalizing means and signal location information in said signal location detection means; and

coupler means for coupling output signals of said n units of demodulation means and an output signal of said signal location detector and outputting (k+n×m)-bit serial signal per symbol.

2. The code division multiplexing communication system of claim **1**, wherein said spread means comprises means for spectrum spreading a data signal based on a Barker code; said correlation means comprises means for taking a correlation between an output signal of said analog operation means and a Barker code and outputting a signal based on a correlation result.

3. The code division multiplexing communication system of claim **1**, wherein said equalizing means comprises equalizing operation means for removing a delay distortion from an output signal of said correlation means for equalization and tap coefficient operation means for obtaining a multipath distortion based on an output signal of said correlation means and outputting said multipath distortion as a tap coefficient of said equalizing operation means.

4. A code division multiplexing communication method for transmitting and receiving a digital signal through spectrum spread, wherein

a transmission side comprising the steps of:

dividing (k+n×m) bit serial input signal per symbol timing to n pieces of m bit parallel signals, wherein each k,m is at least 1 integer, and n is at least 2, and outputting j variations of m bit data signals each at a differently-shifted timing from said parallel signals and j selection signals for selecting said m bit data signals, wherein j is an integer also ${}_jC_n \geqq 2^k$;

generating j spread codes each at a differently shifted timing;

generating j spectrum spread signals based on said m bit data signals and said spread codes;

selecting and synthesizing n signals among said j spectrum spread signals based on said selection signals;

modulating said selected and synthesized signal; and

converting a frequency of said modulated signal into a radio frequency; and

a reception side comprising the steps of:

receiving a signal at a changed frequency and converting said reception signal into a base band signal;

taking a correlation between said base band signal and said spread codes for outputting a signal based on a correlation result;

equalizing a signal based on said correlation result and removing a delay distortion generated on a transmission path from a signal based on said correlation result and outputting a signal carrying no delay;

detecting timing locations of n signals at the highest level within 1 symbol block and extracting k-bit information from said timing location;